Section II (Remarks)

Amendment of Claims 1 and 22; Introduction of New Claim 43

Claims 1 and 22 have been amended and new claim 43 has been added.

Claims 18-21 and 37-42 have been withdrawn from consideration as being directed to non-elected embodiments.

No new matter within the meaning of 35 U.S.C. §132(a) has been introduced by the amendments of claims 1 and 22, or by the introduction of new claim 43.

The amendments to claims 1 and 22 incorparate features/capabilities of the electrode apparatus relating to detachability of the measuring electrode from the measuring circuit, specify the cleaning process as galvanodynamic and as being performed in the measuring chamber, and in claim 1 indicate that the cyclic current is applied until sufficient cleaning is attained ("for a sufficient number of cycles to effect an *in situ* galvanodynamic cleaning and depassivating of the measuring electrode").

Such amendments are consistent with and supported by the orignally filed disclosure of the application at paragraphs [0031], [0032], [0035], [0039], and [0040] thereof.

Newly added claim 43 recites the "method of claim 22, wherein the cyclic electric current is applied until the electropotential measured by the measuring electrode reaches an asymptotic limit." Such claim is consistent with and supported by the originally filed disclosure at paragraph [0040] thereof.

Rejection of Claims Under 35 USC §102

In the March 23, 2007 Office Action, claims 1, 2, 9-17 and 22 were rejected under 35 USC §102(b) as being anticipated by Robertson (U.S. Patent No. 6,758,960). In the accompanyng

statement of rejection, Robertson was discussed as disclosing an electrode assembly for analyzing a metal electroplating solution, comprising a measuring electrode and an *in situ* cleaning mechanism including an auxiliary electrode and an auxiliary current source, whereby with the measuring and auxiliary electrodes being detachably connected to the auxiliary current source and the auxiliary current source supplying an alternating current across the measuring and auxiliary electrodes.

Applicants respectfully traverse the rejection and request reconsideration in application to the claims as amended.

"Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration." *W.L. Gore & Assocs. v. Garlock*, 721, F.2d 1540, 220 USPQ 303 at 313 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). No anticipation is present here.

Robertson applies an alternating current from an auxiliary current source between the measuring and auxiliary electrodes in order to decompose water by electrolysis and generate gas bubbles that physically translate and remove deposits on the measuring electrode.

Applicants' claimed apparatus, by contrast, employs a direct current source, with direct current being cycled between positive and negative values to oxidize/reduce the surface residue species absorbed on the measuring electrode. This direct current also generates hydrogen and oxygen micro-bubbles on the surface of the electrode to assist removal of any non-oxidizable or non-reducible residues on the electrode surface.

Thus, amended claims 1 and 22 recite that the cleaning process is a galvanodynamic process. A galvanodynamic process by definition is one involving direct current.

Since Robertson contains no disclosure whatsoever of using direct current or any galvanodynamic process, Robertson fails to anticipate applicants' claims 1, 2, 9-17 and 22.

It therefore is requested that the rejection of claims 1, 2, 9-17 and 22 based on Robertson be withdrawn.

Rejection of Claims Under 35 USC §103

The various §103 claim rejections in the March 23, 2007 Office Action are discussed below, in application to the claims as herein amended.

Rejection of Claims 1-5, 7, 9-17, 22-25, 27 and 29-36 Over Chang, et. al. in view of Wullschleger, et. al.

In the March 23, 2007 Office Action, claims 1-5, 7, 9-17, 22-25, 27 and 29-36 were rejected on §103(a) grounds as unpatentable over Chang, et al. (U.S. Patent No. 5,192,403) in view of Wullschleger, et al. (U.S. Patent No. 4,772,375).

In the statement of rejection, Chang et. al. was cited as describing an electrode assembly for anyalyzing a metal electroplating solution, including a measuring electrode and a cleaning mechanism comprising an auxiliary electrode and an auxiliary current source (a potentiostat), with the auxiliary current source being connected to both the auxiliary electrode and measuring electrode so that when both electrodes are immersed in a cleaning solution, the current source applies a cycling electric current for cleaning the electrodes.

Chang et. al. is acknowledged in such statement of rejection as not explicitly disclosing that the electrodes are detachably connected to the auxiliary current source, but it is contended that it is well known in electroanalytical art to make various electrodes detachably connected to a voltage source as demonstrated by Wullschleger et. al. The statement of rejection further indicates that the precise meaning of *in situ* as used in the claims is unclear and reflects an intended use or, alternatively, is obvious in view of Wullschleger et. al., citing column 4, line 49 through column 5, line 32 of such reference.

The Office Action contends that it would have been obvious to one of ordinary skill to utilize the Chang et. al. cleaning mechanism *in situ* with the measurement chamber taught by Wullschleger et. al., to avoid the complexity of having to physically move the measuring electrode back and forth from the measurement chamber to the cleaning chamber.

Applicants respectfully traverse such rejection and request reconsideration.

Chang et. al. discloses two different electrode cleaning processes. Both require that the cleaning process is conducted in a separate chamber/apparatus, away from the measuring chamber. The process alluded to in the Office Action (at column 7, lines 52-65 of Chang et al.) is characterized by Chang et. al. as a more stringent process. Given the "more stringent" nature of the process, there is no basis in Chang et al. and/or in Wullscheger for one to modify such process.

Further, even if this were not the case, Chang et al.'s cleaning process employs potential cycling. By contrast, applicant's claimed electrode assembly as broadly recited in amended claim 1 requires an auxiliary current source, in which

> **"the auxiliary current source applies a cycling electric current to the measuring electrode and the auxiliary electrode through said sample metal electroplating solution or electrolytic cleaning solution for a sufficient number of cycles to effect an *in situ* galvanodynamic cleaning and depassivating of the measuring electrode"**
>
> - (claim 1, amended; emphasis added).

Applicants have found that current cycling is more effective and more controllable than potential cycling, particularly for removing adsorbed organic components from the electrode. Chang et al., however, contains no disclosure whatever of the galvanodynamic cleaning components and methodology required by applicants' claims.

Wullschleger et. al. does not overcome Chang et. al.'s deficiency.

Wullschleger et al. describes a cleaning proces in which reversing the direction of the current in the measuring cell enables the oxidation of chloride ions in the cell to generate chlorine gas that in turn diffuses through a membrane to kill any biological deposits and growth on the exterior surface of the membrane (see column 4, line 49 to column 5, line 3).

Wullschleger et. al. also discloses that chlorine hydrolysis produces hypochlorous acid and hydrochloric acid, which results in a pH depression for dissolving inorganic mineral deposits. These deposits are on the surface of a membrane. The only "cleaning mode" activity in Wullschleger et al. related to the two electrodes is the regeneration of the lead electrode, the

anode, by reduction of lead oxide formed during analysis. Nothing is said of the platinum electrode, the cathode or working electrode, where the oxygen is detected. Wullschleger et al. is devoid of any disclosure of cleaning or removing deposited or adsorbed materials, especially deposited or adsorbed organic and inorganic components of an electroplating solution, from the working electrode, and there is no disclosure whatever in Wullschleger et al. of any plating or deposition on the working electrode.

Since Wullschleger et. al. is concerned with the cleaning of a membrane that is removed from the electrodes and says nothing of cleaning of the electrodes themselves, there is no reason for one considering Chang et. al. to look to Wullschleger et. al. for alternative electrode cleaning methods, because Wullschleger et. al. doesn't disclose any.

There citation of Chang et al. in view of Wullschleger et al. fails to present any *prima facie* basis for combining these references in any way that would yield applicants' claimed invention.

Withdrawal of the rejection of claims 1-5, 7, 9-17, 22-25, 27 and 29-36, over Chang, et al. in view of Wullschleger, et al., is therefore requested.

Rejection of Claims 3-5, 7, 23-25 and 27 Over Robertson in view of Chang

In the March 23, 2007 Office Action, claims 3-5, 7, 23-25 and 27 were rejected under 35 USC §103(a) as being unpatentable over Robertson in view of Chang.

In such rejection, Roberston has been cited as disclosing all of the limitations of the claims except for use of sulfuric acid. Chang et. al. was cited as disclosing the use of a 0.1M sulfuric acid solution as a cleaning solution. The rejection is based on the alleged obviousness of using the Chang et. al. sulfuric acid solution in Roberston because sulfuric acid "was shown to be a suitable acid for the acid cleaning of measuring electrode for an electroplating solution device" (Office Action, page 5, paragraph 12).

Such rejection is traversed.

Even if a 0.1M sulfuric acid solution were extracted from Chang et al.[1], its use in Robertson et al.'s system and process would still not yield the applicants' claimed invention, for the reason that Robertson, as discussed earlier herein, applies an alternating current from an auxiliary current source.

Applicants' claimed apparatus and method, by contrast, employ a direct current source, with direct current being cycled between positive and negative values to oxidize/reduce the surface residue species absorbed on the measuring electrode. Applicants' claim 1, from which claims 3-5 and 7 indirectly depend, recites, *inter alia,*

> **"the auxiliary current source applies a cycling electric current to the measuring electrode and the auxiliary electrode through said sample metal electroplating solution or electrolytic cleaning solution for a sufficient number of cycles to effect an *in situ* galvanodynamic cleaning and depassivating of the measuring electrode"** (emphasis added)

and applicants' claim 22, from which claims 23-25 and 27 directly or indirectly depend, requires, *inter alia,* "an electrode assembly as in claim 1" for "galvanodynamic cleaning and passivating" (emphases added).

Thus, the hypothesized combination of reference disclosures from Robertson et al. and Chang et al. does not equate to or provide any basis for applicants' invention as claimed in claims 3-5, 7, 23-25 and 27.

On such ground, it is requested that the rejection of claims 3-5, 7, 23-25 and 27 based on Robertson et al. in view of Chang et al. be withdrawn.

The Rejection of Claims 6, 8, 26 and 28 Over Chang and Wullschleger or Robertson and Chang Further in View of Faulkner et. al or Tobiyama et. al.

In the March 23, 2007 Office Action, claims 6, 8, 26 and 28 were rejected under 35 USC 103(a) over either Chang et al. and Wullschleger et al. or Robertson et al. and Chang et al. as applied to

[1] It remains applicants' contention that no basis for combination of Robertson et al. and Chang et al. is present in the disclosures of the references themselves, and the respective systems and processes of the two references are sufficiently disparate from one another as to rebut any logic or sense that they should in some way be combined.

claims 5, 7, 25 and 27 above, in further view of Faulkner, et al. (U.S. Patent No. 3,950,234) or Tobiyama, et al. (U.S. Patent No. 5,447,802). In the statement of rejection, the cited references are said to set forth all of the claim limitations except for addition of potassium sulfate to the cleaning solution. Faulkner et. al. and Tobiyama et. al. are cited as teaching the addition of potassium sulfate to electrolytic solutions, including a sulfuric acid solution, to improve the conductivity of the solution. The obviousness of the reference combination is based on the contention that addition of potassium sulfate would be expected to improve the cleaning process of electrodes.

Applicants traverse such rejection.

Each of the rejected claims 6 and 8 depends indirectly from claim 1, which has been patentably distinguished earlier herein over the combination of Chang et al. in view of Wullschleger et al., and claims 3 and 5, from which claims 8 and 6 directly or indirectly depend, have been distinguished earlier herein over the combination of Robertson et al.and Chang et al.

Corresponding claim dependency from previously patentably distinguished claims is present in the method claims 26 and 28.

All of such dependent claims 6, 8, 26 and 28 are therefore patentably differentiated from the cited art, since even if potassium sulfate were extracted from the disclosure of Faulkner or Tobiyama, and imported into the mix of teachings of Chang et al. and Wullschleger et al., or the mix of teachings of Robertson et al. in view of Chang et al., such modification would still not resolve the fact that the resulting combinations would still fail to yield an electrode assembly in which

> **"the auxiliary current source applies a cycling electric current to the measuring electrode and the auxiliary electrode through said sample metal electroplating solution or electrolytic cleaning solution for a sufficient number of cycles to effect an *in situ* galvanodynamic cleaning and depassivating of the measuring electrode"** (emphasis added)

as required in claim 1, from which claims 6 and 8 are indirectly dependent, and as required in claim 22, reciting, *inter alia*, "an electrode assembly as in claim 1" for "galvanodynamic

cleaning and passivating" (emphases added), with claims 26 and 28 likewise requiring such features by virtue of the indirect dependence of claims 26 and 28 under claim 22.

On such basis alone[2], claims 6, 8, 26 and 28 are patentable over the cited references.

It therefore is requested that the rejections of claims 6, 8, 26 and 28 based on either Chang et al. and Wullschleger et al. or Robertson et al. and Chang et al. as applied to claims 5, 7, 25 and 27, in further view of Faulkner, et al. or Tobiyama, et al., be withdrawn.

§103(a) Rejection of Claims 29-36 (and Claims 9-17 in the Alternative) Over Robertson

In the March 23, 2007 Office Action, claims 29-36 (and claims 9-17 in the alternative) were rejected under 35 USC §103(a) as unpatentable over Robertson. Roberston was cited as teaching all the limitations of claims 29-36 with the exception of the claimed current cycling densities or cycling rate, and it was contended that it would have been obvious to find and utilize any of the claimed ranges as a matter of routine skill.

This rejection is traversed, in application to the claims as amended.

Claims 29-36 are of dependent form under claim 22, which requires a method of "galvanodynamic cleaning and depassivating" involving provision of "an electrode assembly as in claim 1."

Robertson applies an alternating current from an auxiliary current source between the measuring and auxiliary electrodes in order to decompose water by electrolysis and generate gas bubbles that physically translate and remove deposits on the measuring electrode.

By contrast, applicants' claimed apparatus as recited in amended claim 1, incorporated by reference in claims 29-36, employs a direct current source, with direct current being cycled

[2] It is further noted in this respect that each of Faulkner et al. and Tobiyama et al. is directed to a plating process, and not to a cleaning process. In view of the clear basis of patentability already established above, such lack of disclosure in Faulkner et al. and Tobiyama et al. of cleaning processes underscores the non-obviousness of claims 6, 8, 26 and 28.

between positive and negative values to oxidize/reduce the surface residue species absorbed on the measuring electrode.

Amended claims 1 and 22 recite that the cleaning is "galvanodynamic," involving the application of direct current.

Since Robertson contains no disclosure whatsoever of using direct current or any galvanodynamic process, Robertson provides no basis for the electrode assembly of amended claim 1, or the galvanodynamic cleaning and depassivating process of amended claim 22.

The electrode assembly of amended claim 1 and the galvanodynamic cleaning and depassivating process of amended claim 22 are required in claim 29, by virtue of claim 29's dependence on claim 22, and claim 22's requirement of "providing an electrode assembly as in claim 1."

Since each of the remaining rejected claims 30-36 depends from claim 29, each of such remaining claims 30-36 likewise requires the electrode assembly of amended claim 1, and the galvanodynamic cleaning and depassivating process of amended claim 22

Claims 29-36 therefore patentably demarcate over the disclosure of Robertson et al.

As a further basis of patentable distinction, since Robertson et al. fails to disclose any galvanodynamic system or process, it is impossible to attribute "obviousness" to Robertson et al. in determining current densities/cycling rates for any such undisclosed system or process.

It therefore is requested that the rejection of claims 1, 2, 9-17 and 22 based on Robertson be withdrawn.

The March 23, 2007 Office Action also has applied an alternative corresponding rejection to claims 9-17 based on Robertson et al.

Such alternative rejection of claims 9-17 based on Robertson et al. is likewise traversed, for the reason stated above. Robertson et al. fails to disclose any galvanodynamic system or process.

Given this failure, the provision of an auxiliary current source arranged to provide specific current densities/cycling parameters for a galvanodynamic system, as set out in claims 9-17,

cannot be obvious based on Robertson et al., for the fundamental reason that Robertson et al. does not provide any galvanodynamic system, and therefore provides no basis for one to provide components for achieving specific current density/cycling operation of such a (non-disclosed) system.

For all the foregoing reasons, the rejections of claims 29-36 and, alternatively, claims 9-17, should be withdrawn.

Fee Payable for Added Claims

The fee payable for added claim 43, of $50, is enclosed in the form of a Credit Card Payment Form authorizing charging of such amount to the credit card identified in the Form.

Authorization also is given to charge any additional fee or amount properly payable in connection with the filing and entry of this response, to Deposit Account No. 08-3284 of Intellectual Property/Technology Law.

CONCLUSION

Applicants' pending claims 1-17, 22-36 and 43 have been shown herein to be patentably distinguished over the art, and otherwise in form and condition for allowance. It therefore is requested that such claims be allowed. If any issues require further resolution, the examiner is requested to contact the undersigned attorney at (919) 419-9350 to discuss same, in order that prosecution of this application may be promptly concluded in favor of an early issue of the U.S. Patent on this application.

Respectfully submitted,

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